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United States Department Of Agriculture
Forest Service
Shasta-Trinity National Forests
2400 Washington Avenue
Redding, CA 96001

Reply To: 3420

Date: June 13, 1989

Subject: Evaluation of Tree Mortality on Goosenest RD, Klamath NF (Rept. No. N89-13)

To: Forest Supervisor, Klamath NF

High levels of tree mortality in several locations on the Goosenest RD, as well as damage to younger growing stock in some timber sales prompted Russ Kazmierczak to request an evaluation of the situation. The areas were examined on May 24, 1989 by Dave Schultz and Gregg DeNitto from the Forest Pest Management Northern Service Area and Russ Kazmierczak and Walt Bavarskas from the District.

Herd Peak

The lower slopes of Herd Peak have a sparse stand of ponderosa pine interspersed with mountain mahogany, manzanita, Oregon grape, and juniper. Most of the ponderosa pine have moderate infections of dwarf mistletoe, Arceuthobium campylopodum. Recent ponderosa pine mortality is quite visible from U.S. Highway 97. The dead trees examined had been attacked by various combinations of pine engravers, Ips spp., western pine beetle, Dendroctonus brevicomis, red turpentine beetle, Dendroctonus valens, and California flatheaded borer, Melanophila californica.

Generally, none of the beetle species seemed very abundant, and in some trees it was difficult to find any beetles. The major problem on the lower slopes is that it is a very dry site. The usual scarcity of water is compounded by dwarf mistletoe and two years of drought. The mortality can be expected to subside as moisture conditions return to normal.

Management Alternatives

1. Do nothing. Mortality will subside in a year or two if moisture patterns return to normal. After the red needles drop from the dead trees, the view from the highway will be similar to the view prior to the mortality. Ponderosa pine mortality will probably be lower for a while due to a lower amount of biomass on the site. As the biomass increases with time and dwarf mistletoe intensifies, there will be additional periods of mortality, probably during the next drought period. The major effect of doing nothing will be a gradual lowering of the ponderosa pine stocking on the site.

2. Salvage dead trees. The major effect of removal of the dead trees would be to recover some wood and cause a rapid reduction in the number of red trees in the stand. If no live trees or brush are removed, there would be no difference in future mortality between this alternative and doing nothing. Soil disturbance caused by harvesting equipment may prepare enough of a seedbed to

result in some natural regeneration. Any natural regeneration that occurs will be infected by dwarf mistletoe from the overstory which will result in stem deformities and stunted growth.

3. Sanitize stand and thin clumps. In addition to the salvage of dead trees, some currently living trees could be removed to benefit the long-term health of the stand. Removal of some overstory ponderosa pine that are severely infected with dwarf mistletoe would reduce some of the source of infection. It would also eliminate some of the trees most likely to become the focal point of a bark beetle group kill. Although much of the area is sparsely stocked with ponderosa pine, there are some clumps of trees which are quite dense for the site. The greatest benefits to the stand would probably be from the removal of smaller, suppressed trees, and trees with severe dwarf mistletoe infections.

4. Clear and regenerate site. While this offers some theoretical advantage of greater control over the site, it is likely to be very difficult and expensive to accomplish. Normal precipitation on the site is adequate to support ponderosa pine, but periodic droughts, a shallow root zone, and southerly aspect could make survival and growth marginal. If based solely on timber production, the site probably can't support a large investment. Projects which also benefit other resources may warrant a larger investment.

Blue Canyon

A second concentration of mortality was examined along an intermittent stream near Blue Canyon. The area was a mixed stand of ponderosa pine and white fir. With the exception of a small amount of white fir regeneration and an occasional juniper, the stand was single storied. The dbh of most trees was 10 to 16 inches and the basal area was 360 square feet per acre.

Almost every white fir in the area was dead, dying, or showed signs of attack by the fir engraver, Scolytus ventralis. Only one ponderosa pine in the area showed evidence of attack by bark beetles, and it was apparently successful in repelling the attacks.

The Blue Canyon area has a mean annual precipitation of about 20 inches. Much of the area would be considered to be in the eastside pine type. White fir is common at the higher elevations and also along some stream courses. Where a seed source exists, white fir will seed in under a pine stand. For a period of about 40 to 60 years, while the fir trees are still young and are protected by the pine canopy, they will appear thrifty. At approximately 60 to 80 years of age, the fir will reach the canopy, be about 12 to 14 inches dbh, and begin producing seed. Once the white fir crowns are exposed in the canopy, the fir trees are at a disadvantage to the pine on dry sites. White fir will not close its stomata in response to water stress until long after ponderosa pine has closed its stomata. On sites where soil moisture is normally limited, and particularly during drought periods, white fir will be the first species to go under water stress and be attacked by bark beetles. In areas where the basal area is high, white fir may transpire so much water before they are attacked that the pine in the stand are also put under stress and subject to bark beetle attack. Because white fir are generally old enough to produce seed before they are killed on dry sites, and white fir seedlings will survive in shade, this situation tends to repeat itself in the absence of fire or selective thinning.

Management Alternatives

1. Do nothing. Most of the pole size white fir in the area examined are dead or dying. Several white fir with intermediate crown positions did not appear to be heavily attacked and may survive until the next drought period. Existing white fir seedlings will probably respond to increased sunlight and, after reaching the canopy in another 40 to 60 years, the scenario will be repeated.

The basal area of the remaining ponderosa pine will probably still be high for the site. As the stand continues to grow and increase in basal area, some ponderosa pine mortality could develop.

2. Salvage dead and dying white fir. This would recover some volume which would otherwise deteriorate very rapidly. It should have no direct effect on future tree mortality in the area. Some white fir regeneration may be destroyed during the harvest although soil disturbance will probably prepare a seedbed for some additional natural regeneration.

3. Manage white fir on short rotations on dry sites. Scattered individual white fir growing on particularly favorable microsites can survive to old age in areas which are otherwise quite dry. However, a high percentage of the white fir growing in areas which receive less than 25 inches of precipitation per year are likely to die before age 80. White fir can be grown with minimal mortality on some dry sites if it can be harvested at age 40 to 60. This may not be practical in areas where there is no anticipated market for smaller size white fir.

4. Manage pine on dry sites. Ponderosa or Jeffrey pine are generally easier to manage than fir on sites which either receive a low amount of precipitation, or are droughty because of aspect or soil conditions. Pines can occupy dry sites for long periods of time if the basal area does not exceed normal for the site and if diseases such as dwarf mistletoe do not build up. If other tree species occur naturally on the site, retaining some of these as a minor component of the stand may contribute to slowing the spread of certain host specific pests. There may be benefits to other resources by retaining some species diversity.

Tamarack Flat

A third situation examined involved damage to fir regeneration in two sales near Tamarack Flat (T.43 N., R.2 E., S.10, and T.43 N., R.1 E., S.13). One sale (Pumice Timber Sale) was currently active although it was actually prepared over a decade ago. The purpose of the sale was to remove a lodgepole pine overstory that was heavily infected with dwarf mistletoe, Arceuthobium americanum, and release an understory that was primarily lodgepole pine with some red fir. In areas where the overstory had been removed before last winter, the foliage of the red fir regeneration was discolored above a height of about 3 feet. The foliage and some buds of the red fir were killed by freezing.

It appeared that until the overstory was removed there was little damage to the small red fir. The upper stems, branches, and some buds were alive on most of the red fir regeneration. Although there may be some dieback, the vast majority of the red fir saplings will produce new foliage from live buds and some will initiate a new leader. The type and condition of vegetation in the area suggests that intense and prolonged cold temperatures are common, so additional

damage to these trees can be expected. Fir foliage in the area which is more than about 16 to 20 feet above the ground shows little sign of freezing damage. Some of the damaged fir saplings may eventually become crop trees if they can survive long enough to get foliage above the level where cold air settles. Some of the fir saplings will sustain enough damage before that point to either die or become severely deformed. If one of the objectives of future sales with similar conditions is to release the fir advance regeneration, it may pay to either wait, or use cultural practices such as a shelterwood harvest, to grow the regeneration above the height where it is damaged by freezing before removing the overstory.

The stand remaining after the overstory removal is densely stocked lodgepole pine with scattered red fir. The pines are seedling to pole-size. A significant level of infection of the pines by dwarf mistletoe is causing deformities and stunting of the smaller trees. Seedling and sapling pines will continue to be infected from above by dwarf mistletoe in the larger pole-size trees.

The current objective for the stand is to grow at least firewood size lodgepole pine. Stand density and dwarf mistletoe will prolong the time needed to reach that objective. There probably won't be much natural thinning until the trees reach several inches in diameter, and then any mortality will likely occur in groups. Dwarf mistletoe will continue to infect and impact the growth of the smaller size classes. At least 8 to 12 decades will be required before the stand is ready to harvest. Removing infected overstory trees and thinning the smaller size classes would shorten the rotation and increase the number of merchantable stems.

An older sale was also examined in the Tamarack Flat area. With the exception of having white fir regeneration present rather than red fir, the stand composition was very similar to the active sale. The white fir regeneration had been exposed for several winters after the overstory was removed. It was apparent that microsite variation was very important in the amount of freezing damage to the fir regeneration. White fir regeneration in depressions or drainages where cold air collected had severe and repeated damage. Some fir trees had enough top-killing and branch dieback that it appeared they would eventually die. The lodgepole pine regeneration appeared unaffected by the cold and the prognosis for the area is similar to that for the active sale.

Management Alternatives

1. Do nothing. The stands that develop will be primarily lodgepole pine, with small amounts of fir. Dwarf mistletoe will continue to infect the lodgepole pine and slow their growth. Stocking will be very irregular, with considerable area occupied by clumps of suppressed or deformed lodgepole pine. The rotation will be long and the final yield of crop trees will be sparse.

2. Remove or kill overstory lodgepole pine. Most of the taller lodgepole pines have dwarf mistletoe infections. Removal, felling, or girdling these trees would eliminate an overhead source of infection of the understory. If the regeneration grows upward more rapidly than the dwarf mistletoe, it offers the possibility of progressively adding more uninfected crown. Elimination of overhead dwarf mistletoe infections alone is enough to shorten the rotation in some aggregations. However, densely stocked aggregations may not respond

adequately in height growth to add sufficient uninfected crown and reduce the effects of dwarf mistletoe.

3. Kill overstory, thin and sanitize understory. Thinning the understory following removal of overstory infection sources would increase its growth, shorten the rotation, and increase the probability of developing uninfected crowns faster than the dwarf mistletoe can spread upward. It would benefit the stand to remove understory trees with heavy amounts of dwarf mistletoe. It may not be possible, and isn't necessary, to leave only trees with no visible dwarf mistletoe infections. Leave trees should be selected based on good crown characteristics, including live crown, and spacing requirements. Trees with bole infections should not be selected if other trees are available. Similarly, heavily infected trees, and those already deformed, should not be selected unless no other trees are available. Trees which will respond to release should be those selected to retain.

If collections from the sale are not adequate to fully fund treatment of dwarf mistletoe in the area, there may be supplemental Forest Pest Management funds available. If you need assistance preparing a funding request or have other questions, please call Gregg DeNitto or Dave Schultz at 916-246-5101.

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